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## ON PERCUSSION AND AUSCULTATORY PERCUSSION OF THE SKULL IN DIAGNOSIS AND TREATMENT.

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CAN we act on the structures within the skull by simple percussion of the head by the finger? Will the force of such a stroke as can be used with safety not simply be diffused over the bone without being transmitted through it? These are questions which may be readily suggested by the title of this paper. It therefore seems necessary to answer them at the outset. In this connection the results of concussion of the brain from injury are worthy of consideration. In most cases there is more or less bruising or laceration of the cerebral tissue. This shows the effect of a severe blow. Duret's<sup>1</sup> observations on cerebral traumatism are however more exact in their indications. He concluded from careful and laborious experiment that at the point of sudden impact a *cône de depression* is formed, which passes through the interior in the line of the thrust to the base of the skull. But it is to clinical facts chiefly that we look for evidence of the effect of a slight stroke. Cases have been recorded by others as well as myself which show that in disease of the cortex of the brain and pia mater, the dura mater, and inner table of the skull, either singly or combined, we can, by the mere tap of the finger on the head, produce an impression on the parts within,

<sup>1</sup> H. Duret. *Etudes expérimentales et Cliniques sur les traumatismes cérébraux*. Paris, 1878.

which may be painful, though previously the patient had not felt pain in that situation.

Obviously it is in the diagnosis of the group of intracranial morbid conditions just named that this method of investigation might be expected to be useful. It is now many years since, by communications to the medical societies and the showing of patients, I directed the attention of the profession in Glasgow to its value in this connection; and at the London meeting of the International Medical Congress in 1881, I submitted a more formal paper on the subject.<sup>1</sup> Since then considerable experience of its use, both in Glasgow and elsewhere, has accumulated, which will be briefly stated. But before doing so it may be well to make more particular reference to the action of percussio.

It is clear that an impression is made on the sensory fibrils in the portion of the scalp which is tapped—the branches of the fifth, the auricular, or the occipital nerves, according to the region under examination. We will consider the area of the fifth. It will be remembered that it is also the sensory nerve of the underlying bone and membranes, both dura and pia mater. The impress of the tap in ordinary conditions is at once transmitted to the great sensory centre in the convolutions where it enters into consciousness. But in morbid states of the corresponding part of the pia or dura it may, in its central progress, at the first station of the afferent

<sup>1</sup> Published in the transactions of the Congress. In the course of the meeting Dr. Ferrier wrote to me that in 1874, in a paper on “Pathological Illustrations of Brain Functions” in the West Riding Asylum Reports for that year, page 54, he had recorded that pain might be elicited by percussio of the skull in the case of morbid growth within. In justice to him I quote his brief remark on the subject:—“The seat of pain, however, does not always coincide with the position of the tumour. In reference to this symptom of cerebral disease, much may be learned by percussio of the skull. On several occasions, by smart percussio, I have been enabled to determine approximately the seat of the disease, and sometimes brought out local pain, though not formerly complained of.” It is clear, therefore, that Dr. Ferrier is entitled to the credit of priority of observation on this point. But he made no suggestion as to general percussio of the skull, nor directed how percussio should be done, nor mentioned the risks of being misled, nor advised any precautions against what might prove to be a dangerous error, were it acted on in practice.

nerve from the scalp be partially reflected downwards on the nerves coming from the seat of disease, or on their nucleus in this station. So far as we at present know, the first meeting place of the external and internal branches of the fifth, where such a transference might take place, is in the Gasserian ganglion.

Possibly in certain cases the morbid part may be wakened into activity through this circuitous route. Its afferent nerves, at least as far as the nucleus, are likely to be in an unduly susceptible state. The recent observations of Mackenzie and Head into the relations of internal organs or parts of organs to definite cutaneous areas, long ago to a considerable extent anticipated by Hilton in his classical work on "Rest and Pain," lend support to this hypothesis. There is also corroborative evidence in the facts of disease; for example, the reflected pains down the arm in some forms of cardiac trouble. However, it is less obvious that the irritated state of nerves in cutaneous areas is reflected on their correspondents in internal organs than the converse, namely, that the morbid condition of the organs within may be in some cases revealed by paraesthesiae or hyperaesthesiae of well defined external surfaces. But probably this reflection of the external on the internal, in disease of the latter, by short circuit from the nearest station, is more common than is generally recognized, and should be borne in mind as a serious possibility in cutaneous affections. No doubt there will be little or no action if the internal organ or tissue is healthy, but if it is in a morbid state, the outside malady may not improbably exert a baneful influence on the progress of the internal one, should it be seated in its cutaneous neural correspondent.

But though directing attention to this as a possible route of the impress in superficial intracranial disease when the skull is percussed, I certainly think that, in the great majority of cases, it is directly transmitted to the seat of lesion. Still, while granting this conclusion, it may be urged as an objection that the cerebral substance is altogether insensitive, and that the investing membranes are only slightly sensitive. This is doubtless true of the brain in health, and, so far as is known, in disease also; as is evinced in *hernia cerebri*, where a patient



may have a slice of his convolutions cut off without experiencing any sensation. The membranes, likewise, when exposed, show little evidence of sensibility. But it is otherwise in disease, especially when subjected to tension, as then they may give rise to pain, which occasionally becomes excruciating.

The pain, it will be observed, is elicited by percussion. Mere rubbing of the part or gentle pressure does not induce it. It is therefore inferred that the disease is not in the bone, unless it be in the inner table of the skull, and if this part be affected it is of great importance that the fact should be known, as morbid action there usually involves the outer and often the inner membrane, as well as the brain itself. However disease of the bone in adults in most cases is syphilitic, and the pain, as a rule, is so considerable as to stand in no need of artificial development to manifest its existence.

We now proceed to describe how percussion of the skull should be practised. Either the middle or forefinger may be used, and the tap given by its point should be of very moderate force, always less than will of itself induce pain. If the physician is not familiar with this mode of investigation, he would do well to first percuss his own head to ascertain the character of the stroke which can be borne without discomfort. It will be observed that it may be of somewhat greater force over the vertex than at the sides of the head or on the brow. In the latter situations it should be gentle, and care ought to be taken to avoid the lines of the supraorbital and temporal nerves.

In the practice of this mode of diagnosis there is considerable risk of being misled in certain cases. Frequently little reliance can be placed on the impressions or imaginary impressions of hysterical patients. In no case, either by word or otherwise, should it be suggested that one part of the head is more likely to be the seat of pain than another. It is always advisable, even though a patient be very decided in pointing to one spot, to verify the conclusion by a second examination. The whole head should be percussed, bearing lightly on the more impressible parts already mentioned. If these precautions are exercised, and the patient still adheres to

his previous statement with obvious conviction, the physician is justified in basing his diagnosis to a large extent on this indication.

Some illustrative cases will now be submitted. In several the indications of local pain were elicited by the tapping, the patient being previously unaware that there was pain in that situation; in a number there was more or less general but indefinite pain, which was localized by its intensity on percussion; while in another group there was slight pain in a particular spot before the tapping, but much more severe for a short time after it.

\* J. W., age thirty-eight. This patient was subject to convulsive seizures, affecting the right arm and leg every three or four weeks. The disease was probably of syphilitic origin. He stated in answer to definite inquiry that he did not suffer from headache, yet when the head was tapped all over with the finger, he without hesitation defined the limits of an area where the tapping was distinctly painful. This was situated on the left side, and was about three inches above and behind the highest part of the left ear. Nowhere else was there any unpleasant sensation, and the patient, who was an intelligent man, was quite unaware that there was any exceptional condition in the region mentioned till his attention was directed to it by the percussion. Besides constitutional treatment ten cantharides blisters were applied in rapid succession over the painful region, and he said they had done him much good. He was dismissed apparently well after being some months free from seizures.

\* H. B., age twelve. This boy was struck with a piece of brick on the left side of the head, about four inches above the summit of the ear, and half-an-inch in front of the parietal eminence. Within a month he became subject to epileptic "absences," and rarer convulsive seizures which began by his head turning to the right. For some weeks he had pain, which at first was severe, but after some weeks passed away. Percussion, however, brought back the pain in an aggravated form, though it subsided in a few minutes. Trephining of the skull was

\* Cases marked with an asterisk were shown at meetings of the Clinical and Pathological Society in Glasgow, and have been already published.

advised, but his father would not consent to the operation being done.

W. H., age thirty-nine. Patient stated that he had been subject to fits about once a fortnight for some years. For a day or two before they occur he has a heavy, severe pain across the middle of the head, extending to about two inches above each ear, which when the attacks are imminent becomes aggravated, and seems to pass from the right to the left side. The seizures begin in the left arm, then pass to the left leg, and thereafter become general. There is no pain in the head, except near the time of the fits. In a free interval the head was percussed with the finger. This developed very distinct pain in an area about midway between the upper part of right ear and middle line of the head. The patient left the hospital before there was time to test the effects of treatment.

\* J. R., age twenty-eight. Patient has been subject for upwards of three years to attacks of Jacksonian epilepsy, affecting chiefly the left arm and hand, at about weekly intervals. He has also suffered often from headaches during that time, but the pain was generally diffused throughout the head in the attack, and he cannot say that one part is sorer than another. Pain was developed by percussing of the head, which was localized in a region not very sharply defined above the right ear and a little in front of it. Though this was anterior to the line of the motor convolutions, it was still sufficiently near it to support distinctly the conclusion as to the site of the lesion derived from the character of the convulsive movements.

Dr. McCall Anderson<sup>1</sup> records a case of cerebral tumour in which he states that the diagnosis was "somewhat supported by the pain which was complained of, and by the tenderness on percussion above and behind the right ear." Dr. George Buchanan successfully removed the tumour by operation.

The kind of case in which cranial percussion has proved most useful in my experience is illustrated by the following brief record:

A lady, age fifty, was accidentally struck on the parietal region of the head by a piece of iron, about two years before coming under my care. She was nervous since the accident,

<sup>1</sup> *British Medical Journal*, March 14th, 1891.



suffered much from headache, and life had become miserable. On careful examination it was clear that there was a little weakness of one leg; but neither the arm nor the face was affected. On the opposite side of the head, about the place where she was struck, percussion was clearly painful. A series of fly blisters was applied over this spot, and she ultimately made a good recovery.

In concluding this portion of my subject, I remark that wherever there is the least ground, judging from the general symptoms, for suspecting that disease may exist superficially within the skull, percussion of the head should not be omitted. Failing any result, no harm will have been produced: when successful, it singles out the part to which, in some instances, remedial applications may be made, with the wellfounded anticipation that not seldom the disease may at least be alleviated, if not removed, while in others it helps to determine the place where surgical operation is required.

#### DIFFERENTIAL PERCUSSION CRANIAL NOTE.

Professor Macewen has drawn attention to the presence of an altered cranial note in distension of the lateral ventricles by fluid. In his work on *Pyogenic Diseases of the Brain and Spinal Cord*, he has given a very full account of its mode of production. Here I shall briefly summarize what he has there stated, and will also submit the result of my own observations on the subject.

Dr. Macewen remarks that when the skull is lightly struck by the tip of the middle finger, the resulting note is modified by the consistency and volume of the contents, and their relative position to the bone. A thin cranium vibrates more easily than a thick one. In the cranium of the infant the percussion note is so slight, dull and flat, as scarcely to be perceptible. In healthy children a dull sound is produced, which is nearly equal all over the cranial vault. In some who are either healthy or at least have no obtrusive diseased condition, a slightly more resonant note results from percussion over the side of the head a little behind and above the upper

and outer angle of the orbit. In healthy adults the note is generally high pitched, imparting the idea of solidity, but in many the bones of the cranium are too thick to permit active vibrations on ordinary digital percussion. It is pointed out that in many, but not all, ricketty children the percussion note is more resonant than normal. In some, where the clear percussion sound was elicited, it was afterwards proven that the lateral ventricles contained fluid, which in these cases was believed to give rise to the peculiarity of the note. In others it was supposed to be due to the porosity of the bone.

It is, however, where the lateral ventricles are much distended with serous fluid that the resonance is greatly increased, and then has a somewhat hollow character. It also varies according to the position of the head. If the head be held much to the side, the note is clearer on the lower one, and if reversed, is dull on the same side when it becomes the upper. In over forty children and young adolescents who have had distended ventricles, this clear percussion note has been found.

Such is a short summary of Dr. Macewen's views and experience on this point. I can fully corroborate his statement regarding the distinctive character of the note where the distension of the ventricles is well marked. Besides seeing some of his earlier cases, in which the special note was very obvious, I have had patients under my own care in whom it was present.

The distinguishing character of the note is less clear where the quantity of fluid is not large. Further, as Dr. Macewen has pointed out, it is sometimes simulated in the large head of rickets. In this condition, as I have seen post mortem, the brain substance may be very soft, much less consistent than normal, and this probably modifies the sound independently of excess in the amount of ventricular fluid.

I have found that the distinctive properties of this or other sound brought out by percussion of the skull, are more evident on listening with the stethoscope at the time the head is tapped than with the unaided ear, especially in cases of dubiety. Putting the stethoscope over the frontal suture at the upper part of one side of the head, a few gentle taps should be made

with the tips of the fingers on the corresponding part of the other side. Though the characteristic note is usually best brought out between these two points, sometimes it is more clearly elicited by altering the line of vibration across the head; and this may be done by moving the stethoscope from one part to another, or changing the place of percussion with the fingers.

Adopting the title which is given to this combined mode of auscultation and percussion, when used in helping to determine the extent of the area occupied by a dilated stomach, I have named it when applied to the cranium—Auscultatory Percussion of the Head.

In health the sound heard by this mode of examination differs materially in youth and mature years. With a view to determine the effect of age in modifying the sound, about five years ago I examined fifty individuals, thirty of whom were children under twelve, and twenty adults. In the child the sound is more hollow and the resonance greater than in the adult. In the latter the vibration is usually comparatively slight. As already mentioned, the conduction of vibrations is most free across the summit of the head about its middle. It is less obvious if, while listening on one side, percussion is made on or around the opposite parietal or frontal eminence, especially the latter.

Macewen's characteristic note, as we have seen, points to the presence of excess liquid within the skull. This is most commonly the result of chronic hydrocephalus, but it may be due to other causes, such as occlusion of the foramen of Magendie, or pressure on the veins of Galen by a cerebellar tumour.

From its relation to the subject under consideration, it may be here mentioned that, in moderate but increasing hydrocephalus, the scalp, particularly over its middle region, may be found soft and relaxed to the touch, and more movable than usual.<sup>1</sup> This is probably analogous to the relaxation of the vagina, os uteri, and other parts at the beginning of parturition

<sup>1</sup>At a meeting of the Glasgow Pathological and Clinical Society on November 14th, 1892, I showed two patients in whom the distinctive note was present, and best heard by auscultatory percussion. In one of them, a girl of sixteen, the scalp was in the condition described.



which in them at least is to be attributed to the provision of nature that prepares them for the process of stretching at a later stage of labour.

"Auscultatory percussion may prove of use in the diagnosis of other lesions which modify the conduction of vibrations along the bones, for example, superficial haemorrhages and new formations in the bone, membranes, and cortex. These, if considerable, may be likely to interfere with the transmission of vibrations. Thus a subdural effusion of blood consequent on injury or apoplectic seizure," or a subcortical collection of pus, "may modify the note by its pressure on the overlying bone, and, if so, the alteration of sound would be a guide to the point at which the operation of trephining the skull should be performed."<sup>1</sup> My colleague, Mr. Henry Clark, mentioned to me that he had a case in which he demonstrated a definite area of dulness on percussion above the ear. He trephined the skull in that situation, and evacuated a large quantity of pus from the temporo-sphenoidal lobe. Other symptoms also pointed to a collection of pus in that situation. The patient made a good recovery.

#### PERCUSSION OF THE SKULL IN TREATMENT.

In considering the question of diagnosis it was shown that we can act on the tissues beneath the skull by a slight tap on the head by the finger. This suggested that percussion so practised might prove useful in treatment. It seemed not unlikely that its slight stimulating impression on the cerebral cortex, if continued for a considerable time, might gradually produce a remedial effect. There were further the action on the sensory nerves of the scalp and the arousing of the patient's attention, both of which might be beneficial.

This digital percussion of the skull was begun in the small asylum under my charge in June, 1893, and since then has been used in twelve cases. They were all women, and the majority suffered from chronic melancholia, the others from stuporose insanity or dementia. Three melancholics recovered, and one of them spontaneously attributed her recovery mainly

<sup>1</sup> Quotation from my paper in the *Lancet* of January 7th, 1893.



to the tapping of the head. In the other two the melancholia was apparently becoming fixed when the cranial percussion was commenced. In a fourth woman, who had for many years suffered from combined melancholia and stupor, there was a marvellous clearing of the faculties after a few days tapping of the head. But she passed into a state of mania, and ultimately died from Bright's disease, which was probably present when the percussion was begun. Two others improved, but in the remaining six there was no appreciable change.

In relation to diagnosis, directions have already been given as to how this mode of percussion should be practised. They are equally applicable to treatment. I would only further add that in the latter it should be limited to the upper and central convexity of the head, from the occiput to the brow. I repeat that it is not advisable to tap on the sides of the head lest any nerve trunk should be struck, as I once did on my own head: the part was sore for several days afterwards. However the risk of injuring nerves is but slight, as, so far as I am aware, in no patient or attendant has it ever happened. The attendants are also referred to, as I have always asked them to percuss their own before percussing the patients' heads, so that they might fully appreciate the force of the stroke which should be used. This method of treatment should be repeated *at least* three times a day, and for about a minute at a time. In some of my patients it was continued for five or six weeks.





